PolyGard® ADT-X3-ModBus Interface

ModBus Interface for ADTX3 Transmitter
Serial No.

User Manual

November, 2012

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GAADTX3MOD_E_1112

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Description ModBus Interface for ADTX3 PolyGard Transmitter

1 General Overview

This description refers only to the ModBus interface of the ADTX3 transmitter series. For commissioning and calibration, etc. it is essential to consider the instructions of the respective PolyGard X3 transmitter.

1.1 Control Mode

In addition to the analog output the transmitter is equipped with a serial interface RS-485 and ModBus protocol.

Analog mode:

The analog output can be selected as current signal with (0)4-20 mA or as voltage signal (0)2-10 V. In the 4-20 mA mode and without any supplementary options, the ADTX3 also works in the 2-wire technique.

ModBus mode:

The transmitter can be connected via RS 485 Interface / ModBus protocol to different devices like, DDC, SPC, BMS, PC etc. as a central unit. In this mode there is an analog input for the connection of an additional 4-20 mA transmitter. The two measuring values are transmitted via the RS-485 interface / ModBus protocol.

The cable topology for the RS-485 bus can be taken from the “Guidelines for wiring and commissioning of the DGC-05 hardware”.

The two control modes are available in parallel.

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2 ModBus Mode

ModBus is an open protocol allowing the communication to different devices like DDC, SPC, BMS, PC software etc. as a central unit.

The ModBus works in the master-slave principle with only one device configured as active master of the system. The ADT-X3 transmitters are always configured as slaves; the master is a central unit or a PC. The PC based software, type XXX by MSR-E is configured as master, too. Therefore you have to pay attention that when calibrating or addressing by means of the MSR-E software package only one device, central unit or PC will be active as master.

2.1 Addressing

Depending on the hardware version addressing of the transmitter is done via an address switch or via ModBus.

2.2 Manual Addressing

Manual addressing is effected via the address switch with 16 addresses and a jumper for selecting the 4 address ranges. Maximum 60 addresses can be adjusted thereby.

Switch position	Jumper pos. 01 = address	Jumper pos. 02 = address	Jumper pos. 03 = address	Jumper pos. 04 = address
0	inactive	inactive	inactive	inactive
1	01	16	31	46
2	02	17	32	47
3	03	18	33	48
4	04	19	34	49
5	05	20	35	50
6	06	21	36	51
7	07	22	37	52
8	08	23	38	53
9	09	24	39	54
A	10	25	40	55
B	11	26	41	56
C	12	27	42	57
D	13	28	43	58
E	14	29	44	59
F	15	30	45	60

2.3 ModBus Addressing

Via ModBus up to 244 addresses are possible. The transmitters are delivered with address no. 245. When plugging-in the address selection cable, type CCS-001, into the connector X12 of the ADT-X3 transmitter, it reports to address no. 246 and indicates the current address at the write register Address 10. 246 is a virtual address only valid as long as the address selection cable is connected to the transmitter.

Assigning a new address / changing an address.

- Connect address cable to X12 of the transmitter.
- Transmitter reports to address 246 and indicates its current address in the read register Add. 10.
- Enter the desired address in the write register Addr. 0 and send it.

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Communication cable set

The cable is used to connect the RS485/USB interface to the service connector X12 of the transmitter. In the OFF position of the selector switch communication is possible to all ModBus units.

In the SELECT mode of the switch the transmitter reports to address 246. Communication is only possible with this transmitter.

The ModBus transmitters are addressed in the SELECT mode. In this mode it is also possible to read out the unknown address of a transmitter.

2.4 Zero-Point Calibration via ModBus

The measured value is displayed in the read register Addr. 2 as normalized value (0-10.000). For the zero-point calibration the value differing from 0 is entered as correction value in the write register Addr. 2 and loaded. The current zero-point correction value can be read from the read register Address 12.

Please observe the running-in period of the sensor, see User Manual ADTX3 transmitter chapter 5 (Calibration)

- Connect calibration adapter carefully to the sensor element
- Apply synthetic air (Flow rate see User Manual ADTX3 transmitter chapter 5 (Calibration), 1 Bar (14.5 psi) ± 10%).
- Wait 2 minute until the signal is stable in the read register Address 2, then take over the zero-point value into the write register and send it. Ready.

  If the zero-point is out of the admissible range (>10% of the measuring range) before calibration, there is no correction of the measuring signal. The sensor has to be replaced.
- Remove calibration adapter carefully by turning lightly. Check the sensor for correct mounting!

2.5 Gain Calibration via ModBus

Attention: Calibration gas is toxic, never inhale the gas!
Symptoms: Dizziness, headache and nausea.
Procedure if exposed: Take the victim into fresh air at once, call a doctor.

The measured value is displayed in the read register Addr. 4 directly as gas value normalized on the measuring range. The new gain factor is determined by division (calibration gas value / current measured value), entered in the write register Addr. 1 and sent.

- Reset current gain factor to 10.000 in the write register Addr. 1 and send it.
- Connect calibration adapter carefully to the sensor element.
- Apply calibration test gas (Flow rate see User Manual ADTX3 transmitter chapter 5 (Calibration), 1 Bar (14.5 psi) ± 10%).
- Wait 2 minute until the signal is stable in the read register Addr. 4, adjust the gain factor in the write register Addr. 1 according to the formula of the gain factor calculation and send it.

  By limiting the gain factor, calibration will not be possible any more when the sensitivity of the sensor reaches a residual sensitivity of 30 %. Then the sensor has to be replaces.
- Remove calibration adapter carefully by turning lightly. Check the sensor for correct mounting!

Calculation of the gain factor

$$\text{Gain factor} = \frac{\text{Test gas concentration}}{\text{Measuring value read register Addr. 4}} \times 10.000$$

By limiting the gain factor to maximum 30.000, calibration will not be possible any more when the sensitivity of the sensor reaches a residual sensitivity of 30%. Then the sensor has to be replaces.

	Signal (Pin 4) not wired correctly	Check the wiring

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3 ModBus Specification

3.1 Interface settings

Baud:	9600
Start bit	1
Stop bit	1
Parity	No

3.2 Read Register description

Addr.	Function	Notes
0	Sensor type	E.g… 1110 for ADT1110 CO-transmitter
1	Versions number	E.g. xXxx = Addressing and calibration via tool
2	Internal sensor measurement value	Value is normalized on the numerical range of 0 to 10.000 Value -10 means sensor error
3	External sensor measurement value	Value is normalized on the numerical range of 0 to 10.000 Value -10 means sensor error
4	Internal sensor measurement value	Value is normalized starting from 0 up to the gas measuring range (e.g. CO 300ppm). Value -10 means sensor error
5	External sensor measurement value	Value is normalized starting from 0 up to the gas measuring range (e.g. CO 300ppm). Value -10 means sensor error
6	Temperature ADC value	Internal temperature value in digits
7	res	For future applications
8	res	For future applications
9	res	For future applications
10	Transmitter Bus address	Own bus address, e.g. 15 Value range from 1 to 255 The address 245 is defined ex works. When the Selector cable is plugged-in, the sensor reports to address 246, but displays its own stored address. (246 isn't stored and isn't valid any more after plug-out. It is only used to find already addressed devices.) EEPROM value must not be changed continuously.
11	Gain factor	E.g. 10.000 non calibrated ex works, value range 3000 to 30.000
12	Zero offset value	E.g. 0 non calibrated ex works, value range 0 to 1.000 The value of this register is subtracted from the measured value.
13	res	For future applications
14	Full-scale value	E.g. 300 for CO sensor. This value is used for the conversion of the registers 4 and 5 in order to calculate the full-scale value.
15	Relay 1 –Setpoint value	Setpoint level for Relay 1
16	Relay 2 –Setpoint value	Setpoint level for Relay 2
17	Output 3 –Setpoint value	Setpoint level for Output 3 (open Collector X9 pin 1)
18	Output 4 –Setpoint value	Setpoint level for Output 4 (open Collector X9 pin 3)
19	Hysteresis	Hysteresis Value from 0 to Full-scale value
20	res	For future applications
21	res	For future applications
22	res	For future applications

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3.3 Write Register description

Addr.	Function	Notes
0	Transmitter B□s address	Own bus address, e.g. 15 Value range from 1 to 255 The address 245 is defined ex works. When the selector cable is plugged-in, the sensor reports to address 246, but displays its own stored address. (246 isn't stored and isn't valid any more after plug-out. It is only used to find already addressed devices.) EEPROM value must not be changed cyclically.
1	Gain factor	E.g. 10000 non calibrated ex works, value range 3000 to 30.000. EEPROM value must not be changed cyclically.
2	Zero offset value	E.g. 0 non calibrated ex works, value range 0 to 1.000 The value of this register is subtracted from the measured value. EEPROM value must not be changed cyclically.
3	res	For future applications
4	Full-scale value	E.g. 300 for CO sensor. This value is used for the translation of the registers 4 and 5 in order to calculate the full-scale value. EEPROM value must not be changed cyclically.
5	Relais 1 –Setpoint value	Setpoint level for Relay 1 EEPROM value must not be changed cyclically.
6	Relais 2 –Setpoint value	Setpoint level for Relay2 EEPROM value must not be changed cyclically.
7	Output 3 –Setpoint value	Setpoint level for Output 3 (open Collector X9 pin 1) EEPROM value must not be changed cyclically.
8	Output 4 –Setpoint value	Setpoint level for Output 4 (open Collector X9 pin 3) EEPROM value must not be changed cyclically.
9	Hysteresis	Hysteresis Value from 0 to Full-scale value EEPROM value must not be changed cyclically.
10	res	For future applications
11	res	For future applications
12	res	For future applications

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4 Notes and General Information

It is important to read this user manual thoroughly and clearly in order to understand the information and instructions. The PolyGard® transmitters must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be followed.

Due to on-going product development, MSR reserves the right to change specifications without notice. The information contained herein is based upon data considered to be accurate. However, no guarantee is expressed or implied regarding the accuracy of this data.

4.1 Intended Product Application

The PolyGard® transmitters are designed and manufactured for control applications and air quality compliance in commercial buildings and manufacturing plants (i.e. detection and automatic exhaust fan control for automotive maintenance facilities, enclosed parking garages, engine repair shops, warehouses with forklifts, fire stations, tunnels, etc.).

4.2 Installers' Responsibilities

It is the installer's responsibility to ensure that all PolyGard® transmitters are installed in compliance with all national and local codes and OSHA requirements. Installation should be implemented only by technicians familiar with proper installation techniques and with codes, standards and proper safety procedures for control installations and the latest edition of the National Electrical Code (ANSI/NFPA70). It is also essential to follow strictly all instructions as provided in the user manual.

4.3 Maintenance

It is recommended to check the PolyGard® transmitter regularly. Due to regular maintenance any performance deviations may easily be corrected. Re-calibration and part replacement in the field may be implemented by a qualified technician and with the appropriate tools. Alternatively, the easily removable plug-in transmitter card with the sensor may be returned for service to MSR-Electronic-GmbH.

4.4 Limited Warranty

MSR-Electronic-GmbH warrants the PolyGard® transmitters for a period of one (1) year from the date of shipment against defects in material or workmanship. Should any evidence of defects in material or workmanship occur during the warranty period, MSR-Electronic-GmbH will repair or replace the product at their own discretion, without charge.

This warranty does not apply to units that have been altered, had attempted repair, or been subject to abuse, accidental or otherwise. The warranty also does not apply to units in which the sensor element has been overexposed or gas poisoned. The above warranty is in lieu of all other express warranties, obligations or liabilities.

This warranty applies only to the PolyGard® transmitter. MSR-Electronic-GmbH shall not be liable for any incidental or consequential damages arising out of or related to the use of the PolyGard® transmitters.

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